Rochester Center for Economic Research

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Working Paper No. 388
August 1994

University of
Rochester

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ABSTRACT

The persistent increase in spending on elementary and secondary schools has gone virtually undocumented and has received insufficient attention. Real expenditure per student increased at 3½ percent per year over the entire period of 1890-1990. A decomposition of the spending growth shows that it was propelled by a combination of falling pupil-teacher ratios, increasing real wages to teachers, and rising expenditures outside of the classroom. Contrary to frequent assertion, these increases cannot be explained by the expansion of education programs for the handicapped. Teacher salary increases, which reflect competitive pressures particularly for females, have nevertheless failed to keep up with wages in other occupations—leading to likely declines in teacher quality over time. Moreover, the magnitude of the wage decline is larger than commonly thought because the relative aging of teachers has masked the sizable declines when teachers are compared to comparably aged people in other occupations. The overall pattern of spending increases points to substantial inefficiencies in the allocation of educational resources, since a growing body of literature indicates that lower pupil-teacher ratios and higher nonclassroom expenditures exert little impact on student performance.

*University of Rochester and Amherst College, respectively. The initial design of this study was discussed extensively with Dean Jamison. Discussions with Finis Welch helped clarify key issues about interpretation of the cost changes. We are also indebted to Stanley Engerman, Robert Strauss, Lori Taylor, and Michael Wolkoff for many valuable comments on an earlier draft. This work was supported by a grant from the Pew Charitable Trusts.

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I. Introduction

Vigorous current debate in academe, in government, and in society as a whole surrounds the growth in health care expenditures over the postwar period. Yet, remarkably, the unremitting growth in U.S. educational expenditures—which by some standards exceeds that of health expenditures[1]—receives only passing attention in most policy discussions. On the contrary, popular discussions often bemoan a perceived lack of commitment to education and concentrate simply on the need to expand resources devoted to education. *A Nation at Risk*, the 1983 report to the U.S. Secretary of Education that is commonly cited as the catalyst for much of the current attention to education, identifies areas of concern in performance and calls for significant increases in resources devoted to education (National Commission on Excellence in Education[1983]). But it never considers directly the history of spending or the cost implications of its recommendations. Perhaps the only serious attention to spending has come through international comparisons, which have been used to argue the case for spending increases.[2] In this debate, school spending as a proportion of gross national product (GNP) is compared, and the U.S. is found to fall far from the top. These data are offered as a possible explanation for the lagging performance of U.S. students.

The absence of data on school expenditure patterns opens the policy debate to a variety of myths and unfounded assertions. Many people, for example, appear to believe that educational spending has been roughly constant in real terms. Thus, they conclude, an effective way to improve

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[1]Using the medical care price index as the deflator, real health expenditures per person in the U.S. grew at a slower rate than real school expenditures per student between 1970 and 1990. Of course, there are serious questions about what is the proper deflator. For education, that is addressed below. For medical expenditures, see Newhouse (1993).

[2]The original publication of the Economic Policy Institute led to considerable debate and reanalysis. See, for example, Nelson(1991). The international data have received additional stature through publication in widely circulated reports such as OECD (1992).

student performance is simply to marshall public support to provide greater resources. Others, acknowledging spending increases, point to the growth in expensive to educate populations (such as handicapped students) or to other similar factors. Yet, the simple data on school expenditure provide a different perspective than is commonly held. During the last 100 years, educational expenditure has risen rapidly in real terms. Part of this reflects growth in the school age population and higher student enrollment. But a far larger portion reflects real increases in expenditure per student. Total expenditure even rose between 1970 and 1990, a period in which public school enrollment declined by over five million students.

The century-long expansion of elementary and secondary school spending may be threatened, however, as student enrollment grows and policy makers and the public become increasingly aware of resource constraints. In order to deal rationally with attempts to control costs, it is necessary to understand the underlying causes of prior growth in spending. To do this, we extract information from a variety of sources and construct a consistent data series tracing the evolution of U.S. schools between 1890 and 1990. These data are employed to decompose the observed growth into a series of more fundamental changes in costs and operations. The cost analysis begins with a decomposition of educational spending into four groups of factors: 1) student enrollment; 2) instructional staff per pupil and the school year length; 3) the price of instructional staff; and 4) other spending. Subsequently we examine the growth in special education, the rise in teacher salaries and the increase in other spending in greater detail.

The focus is specifically on the cost side, although we also consider the ramifications of specific cost changes on the societal return to educational investment. If, for example, spending for a particular input leads to a comparable or even greater rise in the value of educational output, then such spending would not reduce the rate of return to overall educational investment. On the other hand, resources used in low payoff areas reduce the societal return to educational investment. The

evidence indicates that recent increases in per student expenditure which are described below have generally not been accompanied by corresponding improvements in educational outcomes. Specifically, over the past quarter century, it appears that student performance at best remained constant and at worst fell (Hanushek, Jamison, and Rivkin 1993; Congressional Budget Office 1986; Hanushek with others[1994]). Moreover, as we shall discuss, spending has gone to a series of inputs that have not been found to be correlated with student performance in separate production function analyses.

II. Conceptual Background

The economy as a whole has experienced substantial growth in the productivity of labor, and real wages have risen roughly in proportion with the rise in labor productivity during the last 100 years. In high productivity growth rate sectors, costs of production fall as productivity gains outstrip increasing labor costs through substitution of capital for labor and through utilization of superior production technologies. But, as Scitovsky and Scitovsky observed in 1959, the nature of the production process impedes the productivity growth rate in certain sectors, particularly those in which substituting capital for labor is seen as seriously damaging the quality of the good produced.

The view that small classes are a virtual prerequisite for a quality education severely limits the substitution of capital for labor in the education sector.[3] It is therefore not surprising that in many respects, the schooling process has changed little during the last 100 years. While there might be increasing use of audio-visual equipment, computers and other learning aids, the extended use of educational technology does not show up as simple capital-labor substitution. Indeed, the long run

[3]Baumol and Bowen (1965) and Baumol (1967) include education as one of the slow productivity growth sectors of the economy that have faced rapidly rising costs. Federal Council on Science and Technology (1972) attempted to quantify the extent to which this effect was operating in the U.S. education sector.

trend has been one of declining pupil-teacher ratios, or more labor intensive instruction in an effort to improve the quality of schools. In the case of the education sector, the recent pattern of wage increases has placed an additional burden on schools in recent years. Cost pressures have been exacerbated by the rapid rise in the relative wages of all women and of college educated men who together account for a majority of employees in public education.

Though paying a higher price for the same teacher would appear to constitute a pure cost increase which lowers the return to educational investment, this is actually not the case. The special nature of the education sector, where educated workers are an intermediate good in producing education, introduces an unusual twist in decision making about educational investments. Since the value of education, an intermediate good in the production process, rises in proportion to wages paid to educated labor, changes in the price of educated labor do not affect the return to human capital investment. Thus, on a cost-benefit criteria, the rising cost of college-educated labor will not affect the investment decision rule, even though the amount of resources devoted to schooling rises along with the price of educated labor. Similarly, the improved opportunities for women have increased the value of education for girls, which partially offsets the rise in teacher costs associated with higher wage offers for women.

Information for both costs and benefits is needed in order to correctly evaluate the return to educational investments. Changes in the labor market demand for particular skills, the market return to physical capital or a variety of other variables could affect the rate of return to specific educational investments without having any impact on the classroom itself. Proper decisions consider not only the technological relationships of the classroom but also the broader societal environment in which the skills acquired in school are applied.

III. History of Cost Growth: 1890-1990

Between 1890 and 1990 real public expenditure on primary and secondary education in the United States rose from $2 billion to over $187 billion.[4] Importantly, this almost 100 fold increase is more than triple the growth rate of Gross National Product during this period: current educational expenditure increased from less than 1 percent of GNP in 1890 to 3.4 percent of GNP in 1990. (Spending as a percent of GNP actually peaks around 1975 at 3.9 percent; as described below, this percentage is affected noticeably by the demographics of the school age population).

While increasing enrollment accounts for a portion of the rise in spending, rising per student expenditure explains the bulk of the change in educational outlays. Figure 1 plots the increase in per student expenditure that occurs between 1890 and 1990. Real per student expenditure is $164 in 1890, $772 in 1940, and $4,622 in 1990—roughly quintupling in each fifty year period. Figure 1 also divides per student expenditure into payments to instructional staff (teachers and principals) and other expenditure. The unmistakable pattern here is the relative growth of expenditures outside of instructional staff salaries, going from one fourth of total current expenditure in 1890 to one third in 1940 and to 54 percent in 1990 (see Table 1). (As discussed below, other spending includes items directly related to instructional activity and to teacher compensation, but finer division than used here is not possible because of data limitations).

The expenditure analysis begins with a decomposition of changes in instructional staff expenditure and subsequently turns to the remaining expenditure components. Instructional staff expenditure receive primary consideration because it is determined by key policy and choice variables and this expenditure seems most closely and obviously related to the classroom.

The bottom portion of Table 1 documents changes in major variables that affect instructional

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[4]All monetary measures are adjusted by the GNP deflator to constant 1990 dollars. Throughout this paper we concentrate on current expenditure, i.e., total expenditure less capital investment. Unless otherwise noted, we also use public school expenditure, excluding that going to private schools. For the most part, the qualitative results that we present are unaffected by concentrating on this narrower definition of spending.

Figure 1

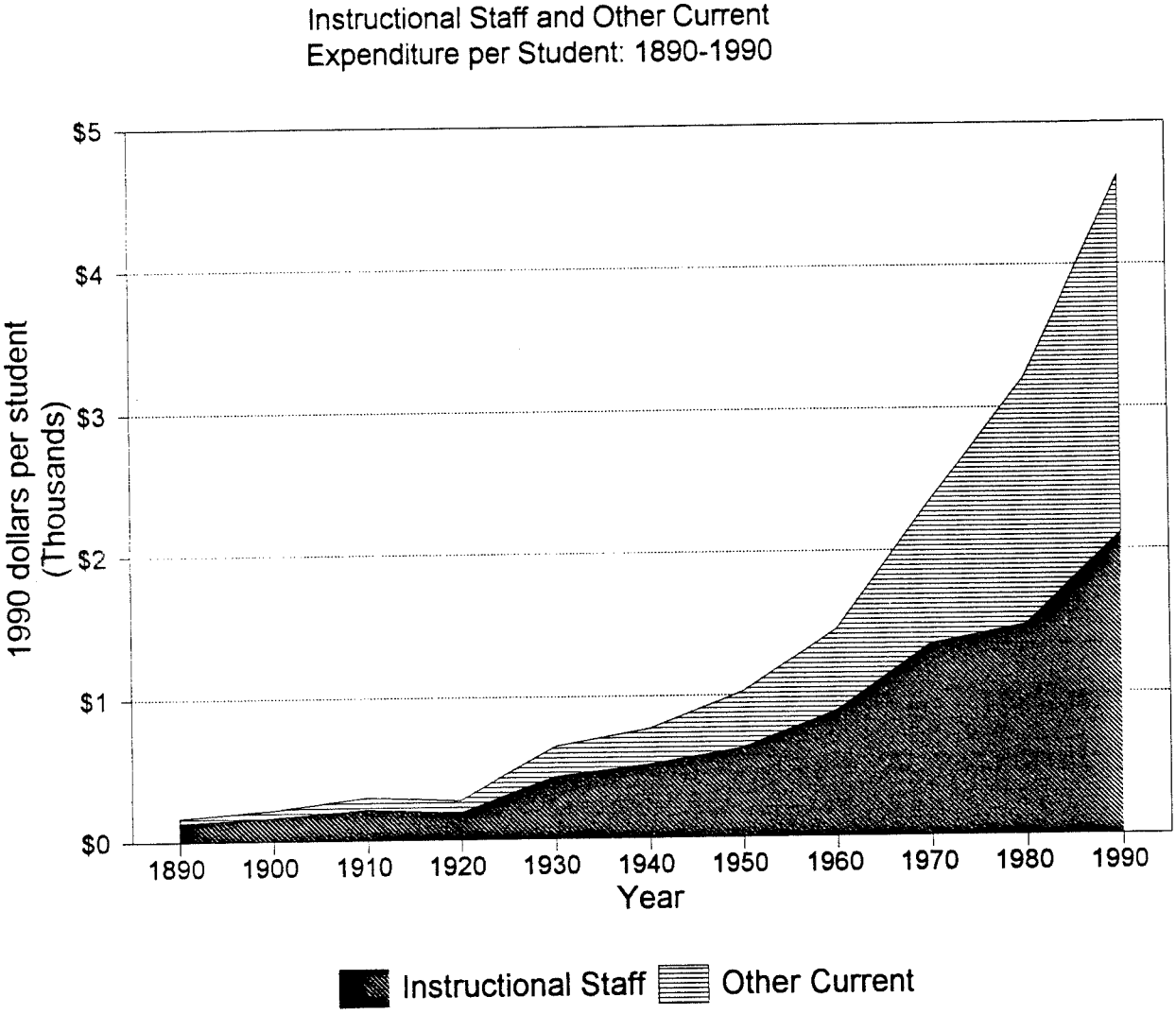
Instructional Staff and Other Current
Expenditure per Student: 1890-1990
1990 dollars per student
(Thousands)
$5
$4
$3
$2
$1
$0
1890
1900
1910
1920
1930
1940
1950
1960
1970
1980
1990
Year
Instructional Staff
Other Current

Table 1. Values of Real Current Educational Expenditure and Key Explanatory Variables: 1890-1990

	1890	1940	1950	1960	1970	1980	1990
TOTAL CURRENT EXPENDITURE (billions 1990$)	2.09	19.65	25.79	52.47	107.1	133.5	187.4
Instructional Staff Expenditure (Billions 1990$)	1.68	13.22	15.78	31.95	61.48	61.41	85.92
Other Expenditure (Billions 1990$)	0.41	6.43	10.01	20.52	45.62	72.09	101.48
QUANTITY							
Pop. age 5-19 (Millions)	21.2	34.8	34.9	48.7	59.8	56.1	53.0
Enrollment Rate (%)[a]	68.4	80.7	81.6	85.8	85.8	83.3	86.7
Public School Enrollment Rate (%)	87.8	90.7	88.1	86.4	88.9	89.1	88.3
INTENSITY							
Pupil/teacher Ratio	35.0	28.1	26.3	24.9	20.5	17.4	15.4
Days per Year	135	175	178	178	179	179	179
INPUT COST							
Daily Wage of Teachers (1990$)	34.2	83.3	93.1	123.7	154.7	143.4	182.8

Note: a. Enrollment rate in elementary and secondary school of population age 5-19.

expenditure. These are loosely grouped into three categories: quantity, intensity and input cost. "Quantity" captures expenditure changes related to student enrollment, which in turn reflect increases or decreases in either the school age population, school enrollment rate, or the division of students among public and private schools. "Intensity" refers to factors that conceptually affect the content or quality of a year of schooling. These include the length of the school year and the pupil teacher ratio. Finally, "input cost" refers to changes in the price of instructional personnel.[5] The specific decomposition of costs concentrates on the central elements of school policy and of overall change in schooling during the century, but other factors surely contribute to cost changes. For example, the relative increase in the proportion of students in secondary schooling as compared to primary schooling would contribute to some of the underlying trend—through reducing class sizes and requiring more expensive teachers. Similarly, unionization has undoubtedly contributed to pressures to reduce class sizes and to increase salaries. For many purposes it is appropriate to view this analysis as a reduced form approach, where the underlying causal factors leading to the changes in intensity and costs are not explicitly appraised.

We define the following identity as a basis for the decomposition:

(1) Instructional Staff Expenditure = POP * ENRATE * PUBLIC / PTRATIO * DAYS * TPRICE

where POP=population age 5-19 ; ENRATE = enrollment rate (number of elementary and secondary students divided by POP[6]; PUBLIC = proportion public school enrollment; PTRATIO =

[5]Teacher quality is a third variable that affects school quality. Though no measure of teacher quality is included in the decomposition, we use Census data to analyze the changing earnings distribution for teachers and other college educated workers in Section IV.

[6]The denominator includes many 18 and 19 year olds who began first grade more than 12 years earlier. These students are likely to be out of secondary school (and maybe already in college), leading to a downward

pupil/teacher ratio[7]; DAYS = school days per year; and TPRICE = average daily wage of teachers and staff. The decomposition of spending growth begins by taking logs of both sides of Equation 1 and then calculating differences between time τ and τ'.

$$(2)\quad \Delta \underset{\tau \to \tau'}{\text{Ln}}(\text{Instructional Staff Expenditure}) = \Delta\text{Ln}(\text{POP}) + \Delta\text{Ln}(\text{ENRATE}) + \Delta\text{Ln}(\text{PUBLIC}) - \Delta\text{Ln}(\text{PTRATIO}) + \Delta\text{Ln}(\text{DAYS}) + \Delta\text{Ln}(\text{TPRICE})$$

Changes over time are calculated by comparing the changes in (logs of) each factor to the changes in (logs of) total spending. Using this accounting framework implies that factors changing proportionately more will account for a greater percentage of expenditure growth.

The proportions of change explained by each of the six variables for different time periods are presented in Table 2. We divide the century considered (1890-1990) into three subperiods: 1890-1940, 1940-1970 and 1970-1990. This divides the postwar period between years of rapid growth in student enrollment and years in which enrollment declines. Finally, in order to capture the most recent changes, we break out the decade of the 1980s.[8] These periods tell a striking story of educational change.

1890-1940. The rapidly rising school age population and increasing public school enrollment rate accounts for roughly one third of the $11.5 billion increase in real instructional expenditure between

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bias in the relevant enrollment rate. Nevertheless, since only changes in enrollment rates affect the cost decomposition, the systematic downward bias in the enrollment rates for all years will lead to little misestimation of the growth in enrollment rates and in costs.

[7]Pupil-teacher ratio is actually pupil-instructional staff ratio. Teachers make up the bulk of instructional staff: At least for the past 30 years, teachers have been an almost constant 90 percent.

[8]Note from Table 1 that total instructional expenditure is virtually constant during the 1970s, and, therefore, the decomposition is not useful. This constancy results from decreases in the school age population and the salaries of teachers that almost exactly offset increases in the intensity of instruction (i.e., decreases in the average pupil-teacher ratio).

Table 2. Changes in Instructional Expenditure Attributed to Input Changes by Periods: 1890-1990 (Percentages)

	PERIOD				
	1890-1940	1940-1970	1970-1990	1980-1990	1890-1990
QUANTITY					
SCHOOL AGE POPULATION	24	35.3	-36.1	-16.9	23.3
ENROLLMENT RATE	8	4	3.0	11.8	6.0
PUBLIC SCHOOL ENROLLMENT	1.5	-1.3	-2.1	-2.7	0.2
INTENSITY					
PUPIL TEACHER RATIO	10.7	20.3	85.4	36.1	20.8
DAYS PER YEAR	12.7	1.4	0	0	7.2
INPUT COST					
PRICE OF TEACHERS	43.1	40.3	49.9	71.6	42.6
TOTAL	100	100	100	100	100

1890 and 1940. The school age population grows by 13.6 million, the enrollment rate rises from 68.4 percent to 80.7 percent, and the percentage of students attending public schools increases by 3 percentage points, yielding an overall increase of 12.7 million public elementary and secondary school students during this period.

Even during this period of rapid expansion, however, per-student spending increases account for two-thirds of the rise in instructional expenditure. The real price of teachers increases by a factor of 2.5, and by itself explains 43 percent of expenditure growth. Changes in the length of the school year and the pupil-teacher ratio (the two elements of intensity) account for over one fifth of the expenditure increase. The average school year lengthens by 40 days. The pupil-teacher ratio declines from 35 students per teacher in 1890 to 28 students per teacher in 1940, a decrease of roughly 20 percent in 50 years.

1940-1970. The immediate postwar period, while differing in details, has a very similar pattern of cost increases to that in the prewar period. Increases in simple numbers of students attending public schools between 1940 and 1970 accounts for somewhat more of the expenditure increase compared to the earlier period. Public school enrollment increases by over 25 million students, accounting by itself for 35 percent of the real expenditure increase. The overall school enrollment rate rises by 5 percentage points during this period, while the proportion of students attending public schools falls by 2 percentage points. But, the role of these latter changes, which were more important before 1940, pales in comparison to the rapid growth of the school age population during the baby boom.

The rising price of instructional staff again accounts for 40 percent of the expenditure increase. It nearly doubles in real terms, increasing from $83 per day in 1940 to $155 per day in 1970. As in the pre-war period, this price increase has the largest impact on expenditure of any of the input changes.

The two intensity components account for the remaining 20 percent of the expenditure increase, but almost all is explained by the declining pupil-teacher ratio since the length of the school year increased little. The pupil-teacher ratio decreases from 28.1 to 20.5 during this 30 year period., a drop exceeding both in absolute and percentage terms the decrease in the previous 50 years.

1970-1990. The character of cost growth in the 70s and 80s changes dramatically from the earlier periods of the century. Public school enrollment falls significantly through 1985, and, although rebounding some, enrollment is 5.6 million students less in 1990 than in 1970, due almost entirely to a decline in the school age population. Nevertheless, total expenditure continues to grow, reflecting the rapid pace of per student expenditure growth.

Since 1970, teacher price changes account for a substantial portion of the increase in per student expenditure, though as Table 1 indicates all of the increase comes after 1980. Between 1970 and 1980 the real price of teachers actually declines by an average of over $10 per day, failing to keep up with the high inflation rates. But between 1980 and 1990 the price of teachers jumps by over $30 per day, imposing tremendous cost pressures on schools. Over the 1970-1990 period, aggregate spending increases attributed to real teacher price increases exceed the aggregate cost savings from the reduced quantity of school children.

The largest factor in expenditure growth, however, is the decline in the pupil-teacher ratio. It falls from 20.5 in 1970 to 15.8 in 1990. This factor by itself would be sufficient to account for 85 percent of the aggregate instructional staff expenditure increase of almost 25 billion dollars between 1970 and 1990. Although the rate of decline slows in the 1980s (see Table 1), its impact on expenditure remains strong. The causes of this fall have been hotly debated. One explanation is simply that schools attempted to protect employment during periods of falling enrollment. Nevertheless, while this may have been the initial motivation, subsequent data indicate that the

reductions have been permanent, resistant to any increase with rising enrollment. An alternative explanation is that these were forced by external changes—notably the increase in required expenditure for education of the handicapped, or "special education." We consider this latter explanation below.

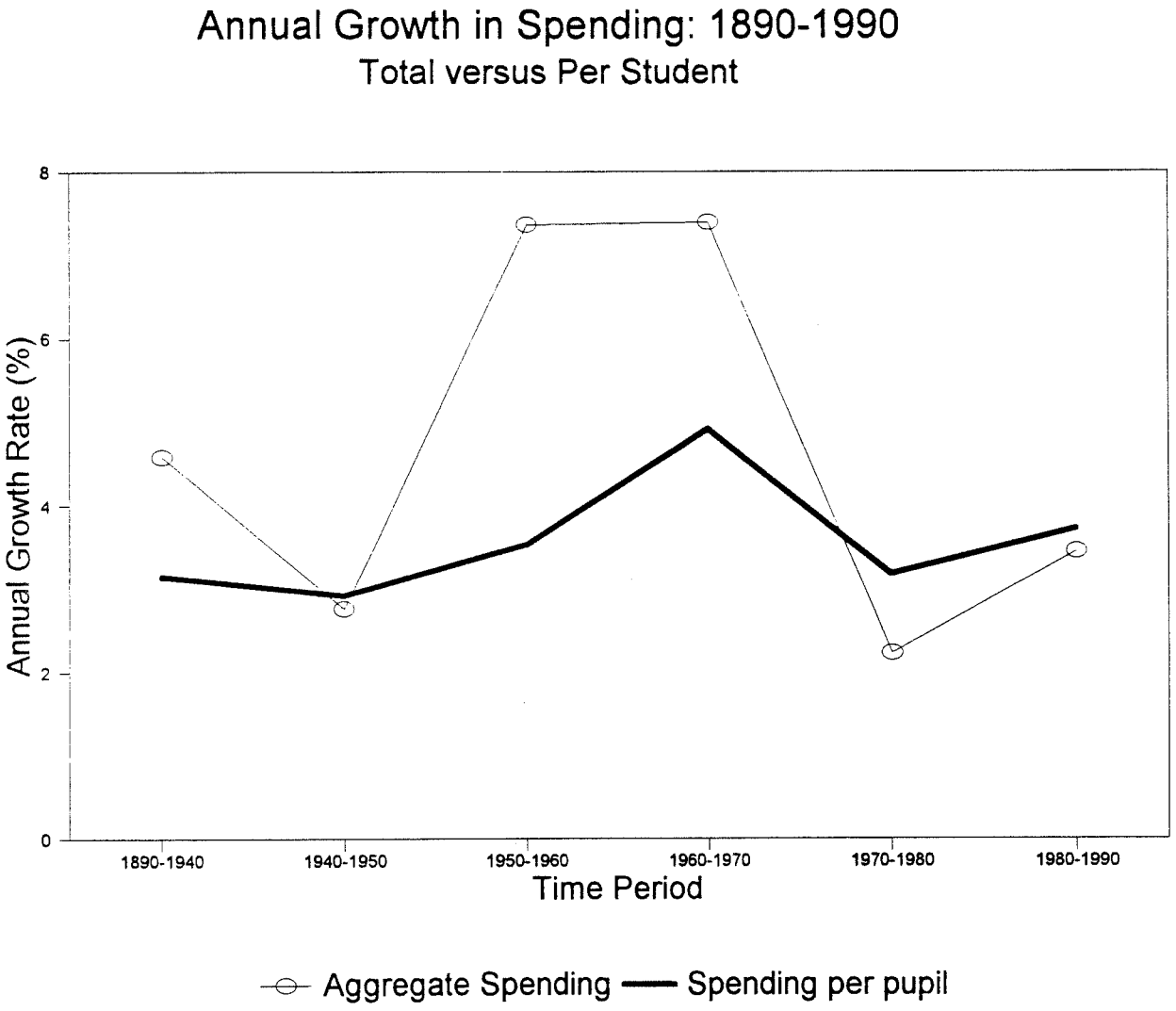
The remarkable increases in spending over the century bears little relationship to the commonly held view that schools are always severely resource constrained. Two factors stand out as being of primary importance throughout the entire period: the rising price of instructional staff and the declining pupil-teacher ratio (see Table 2). These two have been particularly important during the past two decades and will be examined in greater detail in the following two sections.

The decomposition of spending changes may partially explain why public perceptions about school expenditure diverge so significantly from reality. During the last decades, the drop in the school age population effectively masked much of the spending change. Between 1970 and 1990, the fall off in students offset most of the rise in the price of teachers. Therefore, in terms of aggregate spending—and the tax rates required to cover school expenditure—the changes required are less than the increase in real spending per student. This offset was even more dramatic through the first half of the 1980s, when total school population fell each year.

Figure 2 shows the annual growth rates for total spending and for per pupil spending during different time periods. Interestingly, except for the high growth during the 1960s, the average growth in real per pupil spending has been relatively constant—ranging between approximately 3 and 3.5 percent per year over an entire century. The growth rates for real spending per pupil have been approximately double those for real GDP per capita over the same period.[9] But the pattern for total

[9]Annual growth rates of GDP/person grows are 1.2 percent from 1913-1950; 2.2 percent from 1950-1973; and 1.6 percent from 1973-1989 (Maddison[1991, p. 49]).

Figure 2


Annual Growth in Spending: 1890-1990
Total versus Per Student
Annual Growth Rate (%)
0
2
4
6
8
1890-1940
1940-1950
1950-1960
1960-1970
1970-1980
1980-1990
Time Period
Aggregate Spending
Spending per pupil

spending which is affected directly by changes in the growth rate for the student population has been much more erratic, ranging from 2 to over 7 percent per year. The most recent two decades have seen growth in total spending fall below growth in spending per pupil.

This fortuitous situation is changing. During the 1980s, the offset of falling student population stops, and the population begins growing again. Data on school enrollments since 1990 suggest a continued turnabout that will add to aggregate expenditures instead of subtract from them. If the hypothesis that the lack of concern about expenditure increases was the result simply of changes in the aggregate population is true, schools may find themselves facing a much more difficult fiscal situation in the future.

IV. The Declining Pupil-Teacher Ratio and the Expansion of Special Education

The cost movements that are observed in Table 1 suggest that the changes do not reflect adjustments in relative prices: the pupil-teacher ratio declines steadily, regardless of whether the price of instructional personnel increases or decreases. This steady fall in pupil-teacher ratios with the commensurate increase in real educational costs is particularly noteworthy in light of the substantial evidence that variations in class size do not affect student performance. Early experimental evidence is summarized in Glass and Smith(1979). Econometric evidence from estimation of educational production functions is found in Hanushek[1986, 1989]. More recent experimental evidence from the State of Tennessee is presented in Word *et al.* (1990). Each points to a lack of relationship between the fall in pupil-teacher ratios and student performance. Thus, this portion of expenditure appears to be a pure cost increase that leads to inefficiencies and lowers the return to any educational investment.

An opposing view asserts that much if not all of the recent fall in the pupil-teacher ratio is attributable to changes in the school population. The growth in students with identified handicaps coupled with legal requirements for providing educational services for them has increased the size of

the special education sector. Therefore, the expansion of the more highly staff intensive special education sector could reduce the overall pupil-teacher ratio without commensurate decreases in mainstream class sizes. To the extent that mandated expenditure for handicapped students is driving the fall in the pupil-teacher ratio, regular class sizes are not declining and, by extension, one might not expect any improvement in measured student performance.[10] This section provides a simple analysis of the potential importance of special education in explaining the pupil-teacher ratio fall and commensurate increase in educational expenditure.

Concerns about the education of children with both physical and mental disabilities were translated into federal law with the enactment of the Education for All Handicapped Children Act in 1975.[11] This Act prescribed a series of diagnostics, counseling activities, and services to be provided for handicapped students. To implement this and subsequent laws and regulations school systems expanded staff and programs, developing entirely new administrative structures in many cases. The general thrust of the educational services has been to provide regular classroom instruction where possible ("mainstreaming") along with specialized instruction to deal with specific needs. The existence of partial categorical funding from outside and of intensive instruction for individual students creates incentives for school systems to expand the population of identified special education students and incentives for parents to seek admission of their children into special education programs (see Hartman[1980], Monk[1990]). The result has been growth of students classified as the special

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[10]While little evidence is available, it is frequently asserted that special education students do not get included in tests and other measures of performance. Therefore, in assessing performance, it would be appropriate to link expenditure on regular-instruction students with their test performance. On the performance side, however, if a larger proportion of students are identified as special education and if these are generally students who would perform poorly on tests, the shift to increased special education over time should lead to general increases in test scores *ceteris paribus*.

[11]This Act, P.L. 94-142, is commonly identified as having direct and significant effects on the cost and methods of delivery of local education. See discussion and evaluation in Hartman[1980], Singer and Butler[1987], and Monk[1990].

education population even as the total student population has fallen.

The aggregate changes between 1978 and 1990 in the population identified as disabled is shown Table 3.[12] Despite the fact that overall public school enrollment declines by over 1.5 million students between 1980 and 1990, the number of students classified as disabled increases from 4.0 million in 1980 to 4.7 million in 1988. Therefore the percentage of students classified as disabled increases from 9.7 to 11.6 percent during this period. Moreover, the number of special education teachers increases much more rapidly than the number of children classified as disabled. Table 3 shows that the number of special education teachers increases by over 50 percent, rising from 194,802 in 1978 to 307,575 in 1990.

These numbers suggest that the previously noted decline in the pupil-teacher ratio during the 1980s might have been due to a growth in the number of students receiving special education services and to an increase in the intensity of special education (i.e., a decrease in the effective pupil-teacher ratio for special education). While it is not possible to calculate directly special education intensity (since many of the students classified as disabled attend regular classes for much of the day), the impact of the special education changes on overall pupil-teacher ratios can be estimated. Specifically, by assuming historic values for special education students and teachers, we can roughly approximate the impact of the growth in special education on the overall pupil-teacher ratio.

As shown in column 1 of Table 4 the actual pupil-teacher ratio for the years 1980 and 1990 falls from 17.4 to 15.4—a decline of 11.5 percent. The second column estimates what the overall pupil-teacher ratio would have been in 1990 if the observed special education pupil-teacher ratio had remained at its 1980 level instead of falling. Column 3 shows what the 1990 pupil-teacher ratio would have been if, additionally, the proportion of students classified as disabled would have

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[12]Data on special education comes from annual reports required as part of the Individuals With Disabilities Education Act of 1976. Prior to this Act, no consistent data on handicapped students or their schooling are available.

Table 3. Special Education Population and Teachers: 1978-1990

Year	Disabled Children (age 0-21 years) [1,000s]	Percentage of Elementary and Secondary Students	Special Education Teachers [1,000s]
1978	3,777	8.7	195
1979	3,919	9.2	203
1980	4,036	9.7	221
1981	4,178	10.2	233
1982	4,233	10.6	235
1983	4,298	10.9	241
1984	4,431	11.1	248
1985	4,363	11.1	275
1986	4,370	11.1	292
1987	4,422	11.1	296
1988	4,494	11.2	301
1989	4,587	11.4	303
1990	4,688	11.6	308

Source: U.S. Department of Education, *To Assure the Free Appropriate Public Education of All Children with Disabilities*, Thirteenth Annual Report to Congress on the Implementation of the Individuals with Disabilities Education Act, 1991, p. 4, for student numbers and various individual annual reports for teachers.

Table 4. Estimated Effects on Pupil-Teacher Ratios of Changes in Special Education: 1980-1990

	Actual Pupil-Teacher Ratio	Maintain 1980 special education pupil-teacher ratio	
		Actual proportion of special education students	Maintain 1980 proportion of special education students
1980	17.4	17.4	17.4
1990	15.4	15.7	16.0

remained at the 1980 level instead of climbing as it did. The simulations indicate that most of the fall in the pupil-teacher ratio during this period was not caused by the expansion of special education. Even if the proportion of students classified as disabled and the observed special education pupil-teacher ratio had remained constant, the aggregate pupil-teacher ratio would have fallen to 16.0. In other words, by these calculations less than one third of the fall in the pupil teacher ratio can be attributed to increases in special education.

More direct research on the cost of special education also suggests that the growth in special education explains only a small portion of the overall increase in educational expenditure between 1980 and 1990. Chaikind, Danielson and Brauen (1993) find that the costs of educating a child classified as disabled have remained roughly twice the costs of educating a child who does not receive any special education.[13] We obtain rough bound on the increase in expenditure which resulted from expansion of special education by multiplying the increase in the number of special education students during this period (652,000) times the per student expenditure in 1990 ($4,622).[14] The product equals $3 billion, which is quite small in comparison to the aggregate expenditure increase of over $54 billion during this period. Attributing 6 percent of the expenditure increase to special education is roughly identical with the results of the previous analysis of the pupil teacher ratio.[15] Taken together, these rough analyses indicate quite clearly that growth in special education could account for only a

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[13]Special education does mix together students with very heterogeneous circumstances and costs of service provision. Thus, the point estimate masks large and important variations in costs. Nevertheless, there is little reason to believe that the underlying heterogeneity has changed significantly over time, which would be what was necessary to distort the estimated effects on cost growth.

[14]This is an estimate of the "excess" expenditure for special education. This calculation is an upper bound since it ignores any increases over the period in special education expenditure for the pre-existing population.

[15]By the previous calculations, special education could (at most) account for one third of the decline in the pupil-teacher ratio, which in turn accounted for roughly one third of the increase in instructional expenditure, which in turn accounted for roughly half of the rise in total current expenditure.

small part of the growth in per student expenditure in the 1980s.

An alternative estimate of the effects on expenditure of special education comes from direct analysis of state spending reports in New York State. Lankford and Wyckoff (1993) use state financial accounting reports to disaggregate spending in different categories between 1980 and 1992. Using a different decomposition approach, they find somewhat larger proportions of increased funding going to students with disabilities in New York State. Outside of the large five districts (New York City, Buffalo, Rochester, Syracuse, and Yonkers), 19.9 percent of the increased real spending between 1980 and 1992 is attributed to special education.[16] This estimate, while larger than our alternatives, still indicates that the majority of the spending increase is attributable to non-special education related factors.

IV. The Price (and Quality) of Instructional Staff

The desire to reduce classroom sizes has increased the demand for teachers. At the same time, rising labor market wages for both college-educated men and, particularly, women have reduced teacher supply.[17] These supply and demand movements offer a straightforward explanation for the teacher price increase from $34 per day in 1890 to over $177 per day in 1990, an increase that accounts for over 40 percent of the increase in total expenditure on instructional staff over the century. But they tell only part of the story, because schools have also been able to adjust the average quality of teaching personnel by shifting teacher salaries to accommodate shifts in supply and

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[16]Their decomposition of real spending involves additive components for major spending categories in standard financial records. By these data, 60.5 percent of New York City spending growth is attributed to special education, while 24.3 percent in the four next largest districts is related to special education. They do not break the growth in funding into components of numbers served and unit costs which would provide additional information given the incentives to increase the proportions of special education students in New York State.

[17]For a formal analysis of teacher supply and demand, see Flyer and Rosen[1994].

demand. Since potential teachers clearly differ in their skills and consequently their alternative wage opportunities, any increase (decrease) in teacher wages beyond that occurring in other sectors reflects a change in where teachers are drawn from the distribution of workers, and this would be expected to influence teacher quality in the long run.[18]

To trace teacher quality changes, we use annual earnings data for teachers taken from the six decennial Censuses of Population between 1940 and 1990.[19] Annual earnings, which includes money teachers receive in teaching and in other occupations, obviously goes beyond comparing pure teacher salaries to salaries in other occupations. We believe that, while more common, using just teaching salaries concentrates on the wrong comparison, because teachers enjoy much longer vacations than most other workers. Overall earnings better reflect the monetary benefits of being a teacher as opposed to having a different primary occupation.[20] Private school and public school teachers are also grouped together, but, since a roughly constant 10 percent of students attend private schools throughout the period, it is unlikely movement in the earnings of private school teachers will have a significant impact on the overall relative wages of teachers.

Teacher earnings are compared to the earnings of those who do not teach. Specifically, the location of average teacher earnings in the distribution of nonteacher earnings is our primary measure of relative teacher quality. The lower is the percentage of nonteachers who earn less than the average teacher, the relatively worse teaching jobs are when compared to alternative occupations.

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[18]This is not to say that nonpecuniary factors are unimportant in determining whether individuals choose to teach. Rather, we assume that non-pecuniary benefits or costs of teaching have not changed in comparison to those in other occupations, in which case changes in relative earnings functions as a good index of where teachers fall in the labor force.

[19]The category is defined as all teachers below the post-secondary level. As such, it includes some preschool teachers, but these people cannot be separated out before 1980. In 1980, 97 percent of all included teachers were primary and secondary teachers.

[20]This approach still understates the value of teaching occupations because leisure time remains unpriced (and varies systematically by occupation).

The use of percentile rankings as opposed to a comparison of mean earnings reduces problems associated with the Census top-coding of incomes and lessens the impact of changes in the tails of the nonteacher earnings distribution.[21]

The movements in relative earnings of teachers have been dramatic, but, as shown in Table 5, differ noticeably between men and women. While the average male teacher earned more than 84 percent of all males in 1940, this fell to 64 percent by 1990. All of this relative fall, however, occurred before 1960, and, following a slight dip in the 1970s, male teachers have been moving up the earnings distribution. The overall decline in the relative position of women teachers has been almost as large, though female teachers are still better positioned in the earnings distribution than male teachers. But the time path of the decline for females has been very different, with the largest falls occurring after 1970, when the average teacher moved a full 10 percentage points down the earnings distribution.

These aggregate movements in the position of teachers obscure more fundamental changes in the relative earnings of teachers and nonteachers, because they mix together earnings changes relevant to individual workers with aggregate changes in the education levels and age structure of all workers and of teachers. We separate movements in relative earnings for workers at different age and education levels from compositional changes in the workforce. When we do this, we find noticeably different patterns of relative earnings changes than appear in the aggregate.

Specifically, we decompose movements in average teacher earnings along the nonteacher earnings distribution into four factors: 1) pure changes in earnings for teachers and nonteachers (given age and education); 2) increases in college completion rates for nonteachers; 3) changes in the average age distribution for all workers; and 4) changes in the age distribution of teachers relative to

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[21]Preliminary work further shows that the qualitative changes for mean earnings comparisons follow a similar pattern to the percentile movements. See, also, the aggregate comparisons of mean earnings in Appendix Table A1.

Table 5. Position of the Average Teacher in the NonTeacher Earnings Distribution: By Gender, 1940-1990

Year	% male nonteachers earning less than average male teacher		% female nonteachers earning less than average female teacher	
	all workers	college graduates	all workers	college graduates
1940	84.0	52.5	92.3	68.7
1950	73.4	36.2	86.7	55.0
1960	63.3	28.7	86.9	52.7
1970	62.2	25.7	85.8	47.1
1980	53.0	31.0	77.7	50.1
1990	64.0	36.5	75.1	45.3

Source: US Decennial Censuses of Population, Public Use Microdata: 1940-1990

nonteachers. To accomplish this decomposition, we divide teachers into four age groups (20-29, 30-39, 40-49, and 50-59) and divide nonteachers into eight groups by these age categories and by education (college-educated and all others). The mean earnings of teachers equals a weighted average of the mean teacher earnings in each age cell, and the percentage of nonteachers whose incomes fall below the overall teacher mean equals a weighted average of the percentage in each age-education cell whose incomes fall below the overall teacher mean. Changes over time in the percentage of nonteachers who earn less than the average teacher result from within cell shifts in the earnings distribution (*pure wage changes*) and from changes in the age composition of teachers and the age-education composition of nonteachers. Each factor's contribution to changes in the earnings position of teachers is estimated by calculating a series of counterfactual earnings distributions based upon different compositions of workers. Males and females are considered separately.[22]

Consider, for example, the changes in the relative earnings of women teachers between 1940 and 1990. Table 5 shows that between 1940 and 1990 the average women teacher fell from the 92.3 percentile to the 75.1 percentile on the nonteacher earnings distribution, a 17.2 percentage point decline. Table 6 decomposes this overall change into underlying distributional movements. If only the within cell earnings distributions had changed (pure wage changes) but the age distribution of teachers and age/education distribution of nonteachers had stayed at their 1940 values, the average teacher would have fallen to the 80.4 percentile. Thus the use of fixed 1940 cell weights assigns 11.9 percentage points of the decline to pure earnings changes. This might be described as the *ex post* Scitovsky-Baumol effect, because it represents the increasing labor earnings in other sectors and the net result of schools' reaction to such gains. If, in addition, the college completion distribution had

[22]Two primary reasons dictate the separation. First, alternative opportunities for women differ from those for men. Women had opportunities inferior to those of men throughout the period, though their opportunities clearly improved relative to men as time passed. Second, on average women have less labor market experience than men of the same age, because they are more likely to remain out of the labor force for extended periods of time.

Table 6. Sources of Decline in Position of Average Teacher in Distribution of All Workers: 1940-1990, by Gender

	PERIOD				
	1940-1970	1970-1990	1970-1980	1980-1990	1940-1990
MEN					
Pure wage changes	-15.1	-6.2	-13.8	5.4	-21.6
Changes in education levels of nonteachers	-3.1	-3.5	-1.7	-1.5	-5.9
Changes in overall age distribution	0.0	-1.0	-1.0	-3.0	-0.7
Relative changes in teachers age distribution	-3.6	12.5	7.3	4.1	8.2
Total Percentage Point Change in Men Below Average Male Teacher	-21.8	1.8	-9.2	11.0	-20.0
WOMEN					
Pure wage changes	-4.2	-8.8	-6.7	-2.2	-11.9
Changes in education levels of nonteachers	-0.9	-5.1	-2.0	-2.8	-6.3
Changes in overall age distribution	1.3	-2.8	0.0	-1.2	1.1
Relative changes in teachers age distribution	-2.7	6.0	0.6	3.6	-0.1
Total Percentage Point Change in Women Below Average Female Teacher	-6.5	-10.7	-8.1	-2.6	-17.2

changed to its 1990 value without altering the age distribution of teachers or nonteachers, the average teacher would have fallen to the 74.1 percentile, implying that the shift in the education distribution of nonteachers contributed 6.3 percentage points of the change. If, in addition, the age distribution of nonteachers had adjusted to its 1990 value and the age distribution of teachers had changed the same number of percentage points in each cell as had the age distribution of nonteachers, the average teacher would lie on the 75.2 percentile, and the change in the age profile would account for an improvement of 1.1 percentage points. Finally, the difference between 75.2 and the actual 1990 value of 75.1 equals 0.1 percentage points, which is the contribution of teacher age changes vis-à-vis nonteachers.

For men, the early postwar period of 1940-1970 saw dramatic deterioration in the position of teachers, with the average teacher falling 21.8 percentage points to the 62.2 percentile in 1970. The changes in the earnings position during the same period were a more modest 6.5 percent for female teachers. The primary gender difference was much more significant earnings increases outside of teaching for men than for women. Pure wage changes accounted for a 15.1 percentage point drop by male teachers but only a 4.2 percentage point drop by female teachers. The large number of teachers who were hired during the 1960s in response to the demand for smaller classes and a rapidly growing student population also lowers the age composition of teachers in comparison to other workers—contributing an additional 2.7-3.6 percentage points to the decline for female and male teachers, respectively.

In contrast to the earlier period, women teachers experience a much larger erosion of relative earnings than men between 1970 and 1990. Average female teacher earnings fall 10.7 percentage points to the 75.1 percentile, while men actually improve relatively by 1.8 percentage points. But a big part of the difference in aggregate change over this twenty year period comes from the much greater aging of male teachers. Male teachers moved up 12.5 percent in the earnings distribution

simply because they aged significantly as a group compared to nonteachers. (Male teachers age 20-40 make up 68 percent of all male teachers in 1970, but this falls to 41 percent in 1990). The age composition effect for female teachers was also significant (6 percent), but noticeably smaller than that for male teachers. The pure wage effects were more similar with females slipping 8.8 percent and males 6.2 percent. Men and women teachers also fall in the overall distribution because nonteachers increase in overall education levels. Changes in education imply a 3-5 percent decline in the overall relative position of teachers.

The period 1970 to 1990 is actually made up of two distinctly different decades. During the 1970s, the relative earnings of teachers plummeted, due in large part to the decline in the earnings premia for college educated workers.[23] Earnings changes for teachers were much more favorable during the 1980s when shifts in the wage structure resulted in a 5.4 percentage point increase in the position of men and only a 2.2 percentage point decline for women due to pure wage changes. The continued relative earnings decline for women teachers despite their substantial real wage increases during the 1980s resulted from civil rights legislation, technological changes and other factors which expanded employment opportunities and led to commensurate wage increases for women—factors incorporated into the analysis of Flyer and Rosen[1994].

The implication of these changes during the last 50 years is that teachers have been drawn from further down the overall nonteacher earnings distribution. The instructional staff price increase described earlier was therefore far below a magnitude necessary to maintain teacher salaries at their historical locations in the earnings distributions of men and women. To maintain the same relative positions between 1970 and 1990, female real teacher salaries would have had to increase by an additional 20 percent (although male salaries would not have to be increased).

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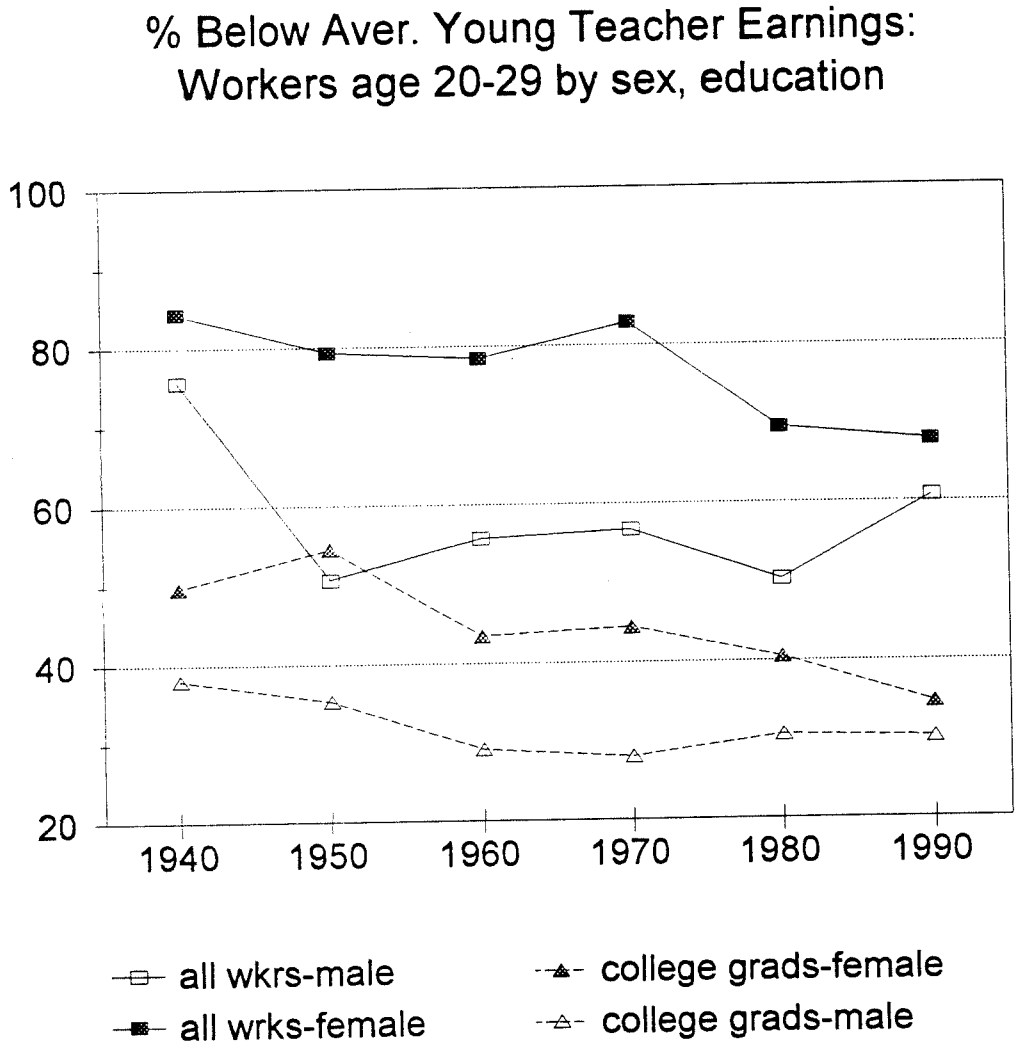
[23]The differences between men and women over the decades reflects differential changes in the college wage premia; see Murphy and Welch [1989,1992] and Hanushek and others [forthcoming 1994].

The large number of teachers who will retire during the 1990s will reduce the total teacher salary bill as new entrants replace more highly paid teachers, but at the same time it is younger women who have enjoyed the largest earnings increases outside of teaching. Figure 3 plots the position of men and women teachers in the nonteacher and college graduate nonteacher wage distributions for new entrants 20 to 29 years old. Two aspects stand out. First, young female teachers wages have deteriorated compared to wages of nonteaching females, whether college graduates or not. Second, the relative position of females is fast approaching that of males, suggesting that counting on a continual supply of high quality female teachers may not be reasonable in the future. These wage changes will put new pressures on schools, because women made up 68 percent of all teachers in 1990. The percentage female in 1990 was up over that of previous decades (see Appendix Table A2), perhaps reflecting the continued lower attractiveness of teaching for males and the influence of expanded female labor supply—situations that are now changing.

Whether the decline in relative teacher earnings has been good educational policy and should be continued depends upon how much teacher performance and educational output would have been improved by the payment of higher salaries. On this question the empirical evidence is mixed. While it may be natural to expect that a decline in teacher quality follows directly any decline in relative teacher earnings, the true effect depends on a number of unmeasured factors including the substitutability between teaching skill and other activities and the ability of schools to hire and retain effective teachers. This consideration is particularly important because research into educational production functions has brought into question how salary and teacher quality are actually related. In studies of the educational production process, there has been little relationship between teacher performance and either teacher salaries or the determinants of teacher salaries (Hanushek[1986, 1989]). This finding does not, however, tell the entire story since the overall level of salaries may influence who enters the teaching profession even if the distribution of salaries across teachers is

Figure 3


% Below Aver. Young Teacher Earnings:
Workers age 20-29 by sex, education
100
80
60
40
20
1940
1950
1960
1970
1980
1990
all wkrs-male
all wrks-female
college grads-female
college grads-male

imperfectly related to performance. Pay increases for most public school teachers do not depend upon classroom performance. The weak link between performance and pay may also account for the mixed evidence on the responsiveness of the teacher supply to changes in relative earnings. Murnane *et al.*[1991] find that higher salaries tend to retain higher IQ teachers, but Hanushek and Pace [forthcoming] find little salary responsiveness of college students training to be teachers. Nevertheless, there can be little doubt the a large fall in relative teacher earnings over a long period of time will eventually exert a depressing effect on school quality.

VI. Other (Noninstructional-Staff) Expenditure

The preceding analysis has concentrated entirely on instructional staff expenditure. Yet, as Table 1 and Figure 1 show, other expenditure has actually risen more rapidly over the entire century. Other expenditure grows from $0.4 billion in 1890 to $6.4 billion in 1940 and to over $100.0 billion in 1990. On average since 1960, this noninstructional-staff expenditure per student rises at 5 percent per year, compared to only 3 percent per year for instructional expenditure. The relative growth of other expenditure is most rapid during the decade of the 1970s, a period when the total school age population drops significantly.[24]

Increasing numbers of students and rising real wages of high-skill individuals surely contributed to the growth in expenditure over the entire period, but other changes must also be important. If, for example, other expenditure had grown at the same per student rate as instructional expenditure between 1960 and 1990, the 1990 per student expenditure would have been $3,480 instead of over $4,622. This would implicitly allow for increased noninstructional intensity because

[24]In terms of absolute growth rates, the decades of the 1950s and 1960s are the largest of the postwar period; this holds for both per capita expenditure and total current expenditure. During these decades, however, both instructional staff and other expenditure were growing in parallel. During the 1970s, instructional expenditure was constant in the aggregate and rose less than 1 percent annually on a per student basis, while other expenditure per student grew at an annual real growth rate of 5.6 percent.

the growth in instructional expenditures includes a fall in the pupil-teacher ratio of a third.

The attention that is given to other expenditure flows in part from a common interpretation that, if it does not relate to instructional staff, this is simply the growth of administrative bureaucracy.[25] Unfortunately, it is difficult to tell exactly what changes have occurred, let alone to judge the efficacy of any such changes. Little consistent data are available to permit any detailed analysis of what lies behind this growth. Moreover, the data that do exist are somewhat misleading since the other category actually includes a variety of items that are conceptually part of instructional expenditure but are labelled noninstructional by accounting convention.

Table 7 shows the overall distribution of expenditure by purpose for the years 1940 to 1990.[26] The two fastest growing categories as a percentage of noninstructional expenditure are "fixed charges" and "other instructional" expenditure. The bulk of fixed charges involves recurrent benefits for staff retirement and health insurance; therefore a substantial portion of these costs actually belong in the instructional staff category. (The growth in health care costs in the 1980s further suggests that fixed charges have most likely continued to grow during this period even though the detail is unavailable). Other instructional expenditure includes the costs of learning materials and school level support staff. The rapid rise in other instructional expenditure is consistent with a very substantial growth in school level clerical and support staff.

The only separately identified category for administration (or, possibly, bureaucracy) is expenditure on central administration, which includes all administration that is outside of the school.

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[25]For example, Secretary of Education William J. Bennett writes, "Too much money has been diverted from the classroom; a smaller share of the school dollar is now being spent on student classroom instruction than at any time in recent history. . . . . It should be a basic goal of the education reform movement to reverse this trend toward administrative bloat and to reduce the scale of the bureaucratic 'blob' draining our school resources." (Bennett[1988, p. 46]).

[26]The 1988 data are less disaggregated than previous years, which is unfortunate since non-instructional staff spending actually declines slightly as a proportion of total expenditure during the 1980s.

Table 7. Percentage Distribution of Current Expenditures: 1960-1990

	Instructional Staff	Other Instruction	Central Administration	Maintenance	Fixed Charges	Other	Total
1960	61	7	4	12	7	9	100
1970	57	11	5	10	10	7	100
1980	46	15	5	11	14	9	100
1990	46	12	42[a]				100

Note: a. Costs for administration, plant maintenance, and fixed charges are not separately available for 1990.

Source: Digest of Education Statistics 1990

Central administrative costs have remained at roughly 5 percent of total expenditure throughout the time period covered. All increases in instructional staff usage have thus been accompanied by proportional increases in administration. The same is true for plant maintenance and the residual category 'other'. The latter includes transportation costs, which have risen substantially during this period,[27] but the fact that transportation costs are small relative to other types of expenditure indicates that their growth has not had a large impact on overall costs.

The growth in noninstructional staff expenditure as a proportion of total current expenditure is indeed remarkable given the instructional staff expenditure rise. Increases in administrative and other instructional spending cannot be attributed to the unique nature of the education production process. School quality is not measured by the pupil/administrator ratio, and technological improvements should have allowed for the substitution of capital for labor. The often heard complaints of administrative bloat appear to find support, but much more precise information is required in order to correctly identify administrative spending which yields little or no return.

VII. Conclusions

Changes in public school enrollment substantially affect educational expenditure. But even if the student population had remained constant throughout the last 100 years, expenditure would have risen by a factor of 25. While specific factors have had relatively greater impacts at different points in time, three stand out as being of primary importance throughout the entire period: 1) the rising price of instructional personnel; 2) the declining pupil-teacher ratio; and 3) rising noninstructional-staff costs.

These cost increases are made much less palatable by the decline in student performance that

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[27]The percentage of pupils transported at public expense increases from 16.3 percent in 1940 to 27.7 percent in 1950, 37.6 percent in 1960, 43.4 percent in 1970, 56.7 percent in 1980 and 61.3 percent in 1988. Transportation costs account for approximately 20 percent of 'other' expenditures.

occurred during the 1960s, 1970s and early 1980s (see Congressional Budget Office[1986], Hanushek, Rivkin, and Jamison[1992], Hanushek with others[forthcoming 1994]). In part, though, performance declines in the face of expenditure increases are not a surprise. Direct analyses of the determinants of student performance indicate clearly that reductions in class size and other common policy choices have little if anything to do with student performance. Thus the observed changes look like pure cost increases, rather than any movement toward higher performance or overall quality changes.

The reduced form approach taken here does not delve into the underlying causes for the observed changes. A variety of plausible hypotheses exist—including the growth of collective bargaining and unionization since the 1960s and the belief that decreased pupil-teacher ratios in the 1970s simply was a way of avoiding teacher layoffs with a shrinking student population. For whatever reason, however, these movements appear to be pure cost factors, and not expansions of quality or the outputs of schools.

One reaction to external pressures from increased earnings has been a deterioration in the quality of teachers, as measured by position in the income distribution. Thus, the adjustment to Scitovsky-Baumol pressures has been through teacher quality and not substitution away from teachers through increases in class size or expanded use of technology. The sudden and recent changes in the relative salaries of female teachers, reflecting expanded outside opportunities, is particularly noticeable and is likely to be felt increasingly in the future. The reduction in the financial attractiveness of teaching that has already occurred has also been understated because the aggregate data commonly employed is heavily influenced by compositional changes, particularly in the age distribution of teachers.

The mystery surrounding school spending is the general lack of knowledge and concern about its magnitude or growth. Most reform proposals simply make no mention of expenditure, implicitly

arguing that 'getting the right programs' is all that matters. One explanation for the apparent lack of concern about the cost side is the pattern of falling student enrollment coupled with a wide-spread belief that we need to improve educational outcomes. The falling student enrollment allows per student expenditure to rise faster than total spending (and, presumably, tax rates). But this fortuitous situation is soon to change as student populations begin rising again. At the same time, tighter local government budgets and expanding employment opportunities for women will place even greater pressure on school district budgets. These may, among other things, spell difficulty for schools as citizens and voters inevitably become more concerned about costs.

The continued support of parents and of taxpayers for more costly school organization also must reflect the difficulty of obtaining reliable and useful information about school performance. Because schools are just one element of learning—a process that also incorporates the actions of parents and peers and a process that adds to very different abilities of individual students, it is difficult to disentangle the role and effectiveness of the schools. The complexity of the process does not, however, distinguish schools and teachers from hospitals and doctors. And, this leads us back to the initial puzzle. The general concern about increasing medical costs is not matched by a similar concern in education. What makes this more puzzling is that the scientific evidence about the ineffectiveness of added expenditure is much more conclusive in the case of schools than in the case of medicine.[28] The fundamental political economy question remains: What drives active decisions that dramatically raise the costs of schooling without improving quality?

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[28]Contrast, for example, the conclusions in Newhouse (1993) and Hanushek (1989).

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Table A1. Average Teacher Earnings Relative to Average NonTeacher Earnings: By Gender, 1940-1990

Year	average male teacher compared to male nonteachers		average female teacher compared to average female nonteacher	
	all workers	college graduates	all workers	college graduates
1940	1.38	0.75	1.67	1.01
1950	1.09	0.67	1.34	0.99
1960	1.08	0.69	1.44	0.96
1970	1.07	0.70	1.45	0.91
1980	0.92	0.67	1.25	0.88
1990	0.94	0.65	1.18	0.80

Note: All comparisons are weighted by age distribution of nonteachers.

Source: US Decennial Censuses of Population, Public Use Microdata: 1940-1990

Table A2. Employment in Teaching: By Gender, 1940-1990

Year	% males employed in teaching of:		% females employed in teaching of:		% all teachers who are female
	all workers	college graduates	all workers	college graduates	
1940	0.6	6.9	2.8	31.0	63
1950	0.7	8.0	3.2	33.0	62
1960	1.2	9.6	3.7	39.2	54
1970	1.5	9.6	4.6	41.3	57
1980	1.7	7.4	4.8	26.3	62
1990	1.6	5.7	4.9	18.7	68

Note: All comparisons are weighted by age distribution of nonteachers.

Source: US Decennial Censuses of Population, Public Use Microdata: 1940-1990